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ERM

2 July 1996
Reference: 94906.40.01

Mr. Randy Sturgeon
U.S. EPA (3HW23)
841 Chestnut Street
Philadelphia, PA 19107

RE: Follow-Up to 7 June 1996 Meeting
Galaxy/Spectron Site, Elkton, MD

Dear Mr. Sturgeon:

At the request of Michael Parr, Environmental Resources Management, Inc. (ERM) has prepared this letter to present a summary of the technical issues and other concerns related to potential applications of low temperature thermal desorption (LTTD) and soil vapor extraction (SVE) remedies for the soil and fill materials at the Galaxy/Spectron Site in Elkton, Maryland. This letter summarizes the key points from our 7 June 1996 presentation to you regarding LTTD, and our discussions regarding SVE. This letter is divided into two sections, in a similar manner to our presentation. The first section summarizes the existing site conditions that relate to the implementation of LTTD and SVE remedies at the site. The second section discusses the engineering and implementation difficulties that would be encountered as a result of the site-specific conditions, and the limited benefits that could be achieved with LTTD and SVE.

Based on the evaluations of LTTD and SVE conducted for the site, we believe that the implementability concerns, short-term risks and limited effectiveness associated with these two technologies make it appropriate to exclude them from further consideration at the site.

EXISTING SITE CONDITIONS

Subsurface Conditions

The Galaxy/Spectron Site was the location of a former paper mill which operated from the 1880's until 1954. During the operational period of the mill there were numerous buildings at the site. The mill was destroyed by fire in 1954 and demolished, and the Galaxy/Spectron operations were constructed in the early 1960's, directly on top of the mill demolition debris. Historical photographs depicting the previous site development conditions are attached as Figures 1 and 2.

Soil borings completed at the site have shown that the site is underlain by up to 10 feet of fill material which consists of coarse-grained soils and significant amounts of demolition debris (concrete, bricks, etc.). The fill is underlain by up to 10 feet of native silty sands, and the underlying fractured bedrock surface is encountered at a depth of about 20 feet below the ground surface. Variable drilling refusal depths and geophysical data have demonstrated that the subsurface material is extremely heterogeneous and that numerous building foundations remain from the old mill structures. There are also a number of underground pipes/utilities which remain beneath the site from both the mill and the Galaxy/Spectron operations. A figure depicting the significant occurrence of drilling refusal and subsurface anomalies is attached as Figure 3.

Ground water beneath the site is encountered within the overburden at a depth of 4 to 6 feet below the ground surface. The water table is typically encountered within the fill or at the base of the fill material, which means that the fill/demolition material is often saturated.

DNAPL/Soils Contamination

The results of the focused Remedial Investigation (FRI) have indicated that residual DNAPL exists beneath the site within the fill material and overburden sediments, and it is likely that scattered DNAPL pockets exist within small-scale bedrock surface irregularities, i.e., bedrock low spots. DNAPL has also been observed within the creek sediments and in bedrock fractures beneath the site and creek. A conceptual cross-section of the subsurface conditions is attached as Figure 4.

As the result of the natural migration characteristics of the DNAPL (i.e., it is denser than water and tends to migrate downward under the influence of gravity), the overburden sediments and fill materials are contaminated below the water table, with the highest levels of contamination existing at greater depths such as at the base of the overburden just above the bedrock surface.

Site Setting

The site is situated along Little Elk Creek in a low density residential setting. During a residential survey conducted by ERM in 1994, approximately 30 homes were identified within a 1/4 mile radius of the site. Several of these homes are in very close proximity (100 yards or less) of the site.

EVALUATION OF TREATMENT OPTIONS

Low Temperature Thermal Desorption

In preliminary evaluations of the potential applicability of LTTD for the Galaxy/Spectron site, potential implementation risks, constructability issues, potential effectiveness, and cost were considered. Application of LTTD would require dewatering to lower the water table, excavation of the impacted fill materials and natural soils, separation of debris, crushing and processing of the large volume of excavated debris, treatment through an LTTD unit mobilized to the site, and on-site backfilling of the treated materials. This application would involve numerous unit processing operations and various pieces of heavy construction equipment. A brief evaluation of LTTD for the site, addressing these considerations, is presented below.

Site Worker and Community Risk

- Disturbance of the site soils associated with the excavation, handling and processing of materials will increase potential short-term risks to on-site workers and the local community via direct contact, mechanical risks, incidental ingestion, and inhalation of volatile and particulate emissions, with inhalation and mechanical risks predominating. The primary contaminants of concern at the site are volatile organics. Volatile emissions measured during site drilling activities ranged from 200 parts per million (ppm) to greater than 1,000 ppm, requiring on-site personnel to use respiratory protection in some cases. The significantly greater site disturbance associated with excavation of the entire site, as compared to drilling, would be expected to result in even greater volatile emissions. This would present the potential for significant community exposure, and/or would necessitate control measures such as an enclosure, which would present confined working space risks (e.g., mechanical, thermal, inhalation) to site workers.

- The debris and rubble present throughout the subsurface would require special handling (i.e., separation and crushing), which would result in greater volatile emissions and associated risks (e.g., the grinding/crushing generates heat which increases contaminant volatilization).
- Because of the limited site size, the limited available space for excavation and material handling activities results in difficult and dangerous work conditions.
- Volatile emission controls (i.e., enclosures, foam) would likely be required which would add to already difficult working conditions. Work within an enclosure is particularly difficult and dangerous because of the limited space available, the presence of mobile heavy equipment, the need for respiratory protection, equipment exhaust, heat, etc.

Constructability/Implementability Difficulties

- The permitting and siting of a thermal treatment unit can be difficult, particularly if there are public concerns.
- The large rubble and debris which cover most of the site to a depth of about 10 feet would significantly impede the progress of excavation equipment. Such large rubble and debris would require specialized excavation equipment, and would cause equipment refusal and damage.
- Along with excavation difficulties, the large rubble and debris would require special handling. These materials would have to be decontaminated or treated separately, and/or processed through sorting, crushing and grinding to allow for thermal treatment. Heterogeneities and miscellaneous debris (e.g., rebar) would further complicate material processing. Previous experience indicates that failures and breakdown likely associated with the required materials handling and processing equipment can result in significant periods of time for processing these types of materials.
- The uneven bedrock surface would add to the difficulty of excavation, and would prevent the complete removal of impacted soils and DNAPL that are present within low spots on the bedrock surface.
- The LTTD processing unit, associated equipment, stockpile areas, etc. would require a significant portion of the limited site area (less than 3 acres). As a result, in order to complete the excavation and

treatment of the entire site, the LTTD unit assembled on-site would have to be dismantled and reconstructed on-site at least once during the project. The limited space results in other logistical problems associated with traffic, stockpiling, etc.

- Because a significant portion of the contaminant mass is below the ground water table, excavation below the ground water table would be required. This would require dewatering, and possibly sheeting and shoring. Complete dewatering may not be able to be achieved, as dewatering systems lose efficiency as the saturated thickness decreases. Dewatering would require the collection and treatment of 2 million gallons of water or more. Sheeting and shoring would be difficult to install because of the unfavorable subsurface conditions (e.g., large rubble and debris, uneven bedrock surface, etc.). Additionally, the heterogeneous subsurface conditions and preferential flow conduits would make effective lowering of the water table difficult.
- Saturated materials excavated from below the ground water table would be difficult to contain, handle and treat. Additional dewatering would likely be required to remove excess moisture prior to further processing.
- The volume of on-site materials (approximately 90,000 cubic yards) is large, and would require a significant period of time for treatment. For example, at a predicted processing/treatment rate of 200 tons per 10 hour work day, it would take more than 1.6 years to treat all of the material, not including down time, weekends, holidays, etc. Including these factors (down time is expected to be significant because of the materials handling and processing concerns), the actual duration of treatment would be estimated to be 3 years or longer.

Effectiveness Concerns

- Once a temporary site dewatering system was shut down, or if a more permanent system had a temporary failure or power outage, the ground water table would rise and return to its natural level in the fill. This ground water would carry dissolved-phase contamination from the bedrock ground water and DNAPL (see attached Figure 5). Recontamination of treated materials placed below the ground water table would occur over time due to this aqueous-phase recontamination, and vapor-phase recontamination of unsaturated materials placed above the ground water table would also occur. These processes were evaluated in detail at a similar site with similar conditions, and were determined to be significant in a Feasibility Study Report prepared for the Tyson's Superfund Site in Pennsylvania which was approved by the EPA Region III.

- Despite the treatment of up to 90,000 cubic yards of potentially impacted materials, this remedy would not address the major contaminant source, which is suspected to be DNAPL that has accumulated on the bedrock surface and within bedrock fractures, and for which there are currently no known effective recovery techniques.
- Overall, the effectiveness of LTTD would be limited, as the potential discharge of contaminants to the ground water and creek would continue (as a result of bedrock DNAPL), and treated soils would be recontaminated to some degree (see Figure 5).

Cost

- The estimated cost for LTTD is $21.6 million. Because this remedy results in no significant decrease in risks (short-term risks actually increase) or contaminant mobility, and only incremental contaminant mass reduction (as a significant mass of DNAPL in bedrock would remain), this approach would not be cost-effective.

Summary

Preliminary evaluations of LTTD treatment options for the Galaxy/Spectron site indicate high potential risk, constructability difficulties, limited effectiveness, and a high associated cost that make LTTD inappropriate for remediating the site.

Soil Vapor Extraction

In addition to LTTD, a preliminary evaluation of soil vapor extraction (SVE) was conducted. Application of SVE at the site would require the installation of vapor withdrawal wells across the site, piping, air removal, handling, and treatment equipment, and associated components of an SVE system, and long-term operation and maintenance of the system. SVE would potentially address volatile contaminants within the unsaturated zone. Lowering of the water table could be attempted to facilitate treatment of materials currently located below the water table. A brief evaluation of SVE for the site is presented below.

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Implementability

- The presence of large debris, rubble, foundations, etc. would inhibit the proper installation and placement of vapor withdrawal and air injection wells at the site (drilling refusal was common during the remedial investigation).
- If dewatering was attempted to facilitate potential vapor extraction below the water table, the installation and proper placement of dewatering wells would be difficult because of the subsurface rubble and debris.

Effectiveness

- Because SVE is generally only applicable to unsaturated soils (because saturated soils do not have pore spaces or interconnected flow zones required for contaminant volatilization and vapor withdrawal), the effectiveness of SVE would be limited at the Galaxy/Spectron site because the majority of contaminant mass is located below the ground water table in the natural soils and bedrock.
- The presence of large debris and rubble in the subsurface would further limit SVE effectiveness because of preferential air flow pathways that would be caused by the heterogeneous subsurface conditions. The presence of preferential air flow pathways within the subsurface would prevent the removal of contaminants from zones that are not in the vicinity of these pathways. By restricting air flows, DNAPLs would also lower SVE effectiveness by reducing contaminant removal efficiencies, and would require long cleanup durations.
- If drawdown of the ground water table was conducted in conjunction with SVE (e.g., dual-phase extraction) in an attempt to facilitate SVE of the soils below the natural ground water table, the effectiveness of SVE in this zone is expected to be low. Recovered ground water would require treatment and discharge. Effective lowering of the ground water table would likely be difficult because of the heterogeneous materials and ground water flow conditions. Residual moisture and fine-grained (e.g., silty) materials within this zone below the natural ground water table would further reduce SVE effectiveness by limiting air flow. If and when dewatering was discontinued, the treated soils would be subject to aqueous-phase and vapor-phase recontamination as discussed previously for LTTD.

- The limited effectiveness of SVE for the Galaxy/Spectron site can be partially predicted by the limited effectiveness of SVE at the EPA Region III Tyson's Superfund site. The limited effectiveness of SVE at the Tyson's site (i.e., long treatment time, high cost, and limited contaminant mass removal) was determined to be a result of unfavorable subsurface conditions that are similar to those present at the Galaxy/Spectron site (e.g., DNAPLs, zones of high moisture content, subsurface heterogeneity, zones of fine-grained materials, etc.).

Cost

- The estimated cost for SVE is approximately $10 million, including a $2 million installation and start-up cost, and $8 million total for 15 years of operation and maintenance. Because this remedy results in no significant decrease in risks or contaminant mobility, and only incremental contaminant mass reduction (as a significant mass of contamination would remain within the saturated zone soils and the underlying bedrock), this approach would not be cost-effective.

Summary

Based on preliminary evaluations of SVE for the Galaxy/Spectron site, SVE is not considered to be an appropriate remedy because of the implementation problems, limited effectiveness and high cost (approximately $10 million).

SUMMARY AND CONCLUSIONS

As discussed during our 7 June 1996 meeting, and summarized in this letter, LTTD and SVE are not appropriate remedial alternatives for the Galaxy/Spectron site. As a result, these alternatives can reasonably be excluded from further evaluation in the upcoming Feasibility Study for the site.

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Please feel free to call Michael Parr at (302)773-0613, Ed Sullivan at 610-524-3848 or Steve Fulton at 610-524-3531 if you have any questions regarding this letter.

Sincerely,

Edward Sullivan

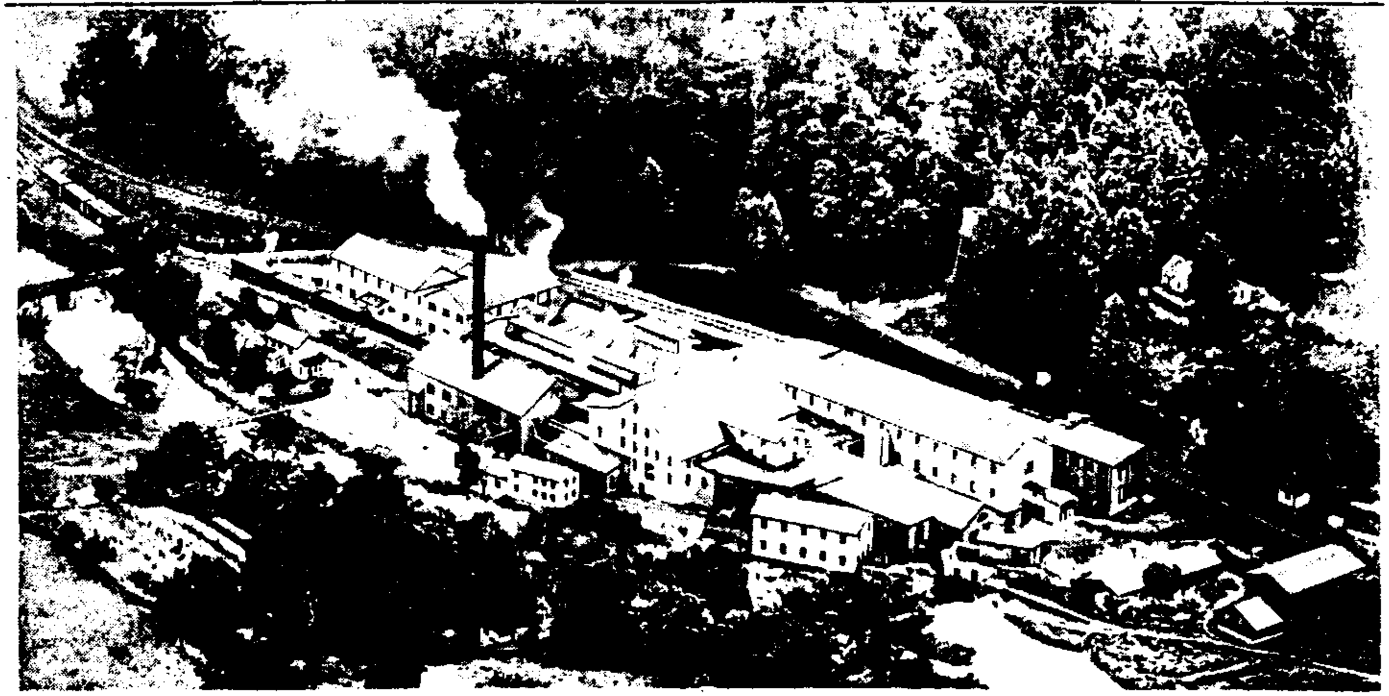
Edward Sullivan, P.G.
Project Manager

Stephen Fulton, P.G., P.E.
Sr. Engineer

ES/SF/ldg

cc: Michael Parr - DuPont
Technical Committee
Tim Joness - de maximis, inc.

A member of the Environmental
Resources Management Group



Kenmore Mills Produced Paper For 73 Years

The sketch above shows Kenmore Mills, Providence, which was built in 1881 and ceased operation when it was destroyed by fire in 1954. The 1919 Historical and Industrial edition of the Cecil Whig said: Kenmore Mills, the capacity of this mill-is about 85,000 pounds of paper daily, comprising book paper, machine finish and super calendar. The plant employs hands or more, on six-day weekly runs, under the ploys 200 hands or more, on six-day weekly runs, under the management of Superintendent David Lindsay. This has made Providence, where the plant is located, the largest and most thrifty village in the Fourth district.

FIGURE 1

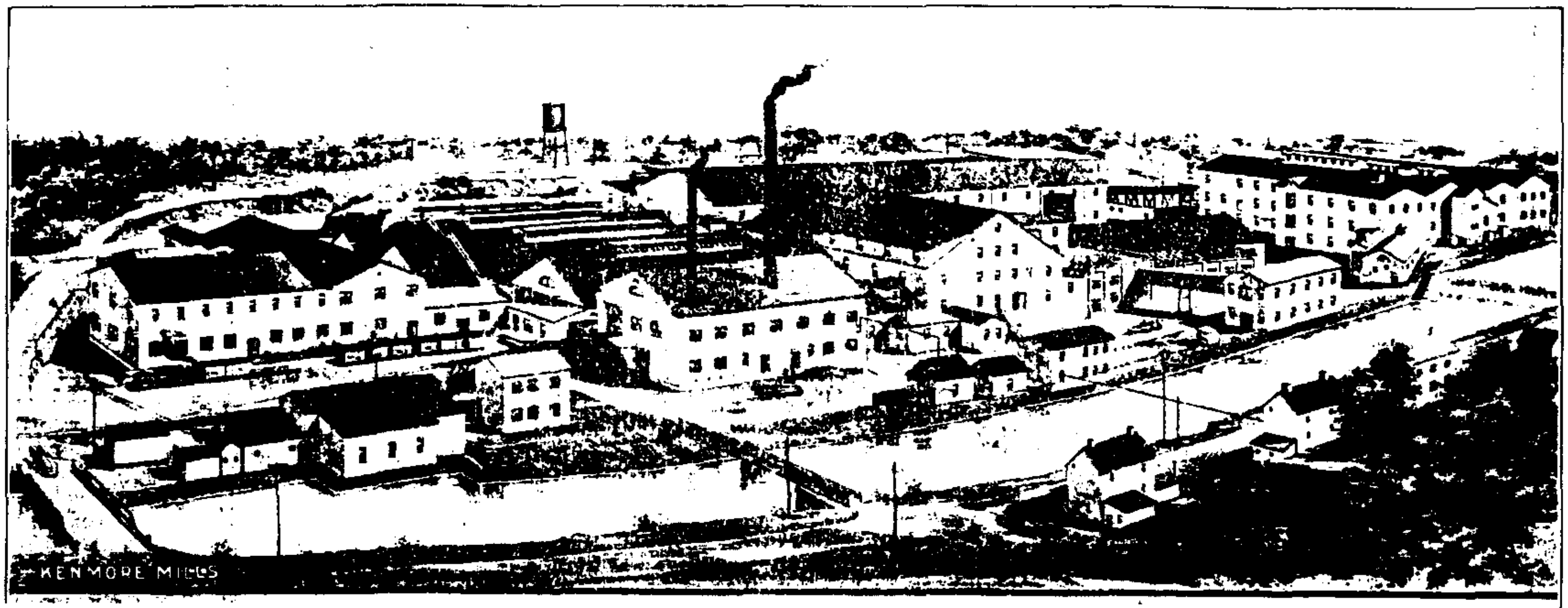


FIGURE 2

FIGURE 3

= Geophysics Anamoly

● = shallow geoprobe refusal

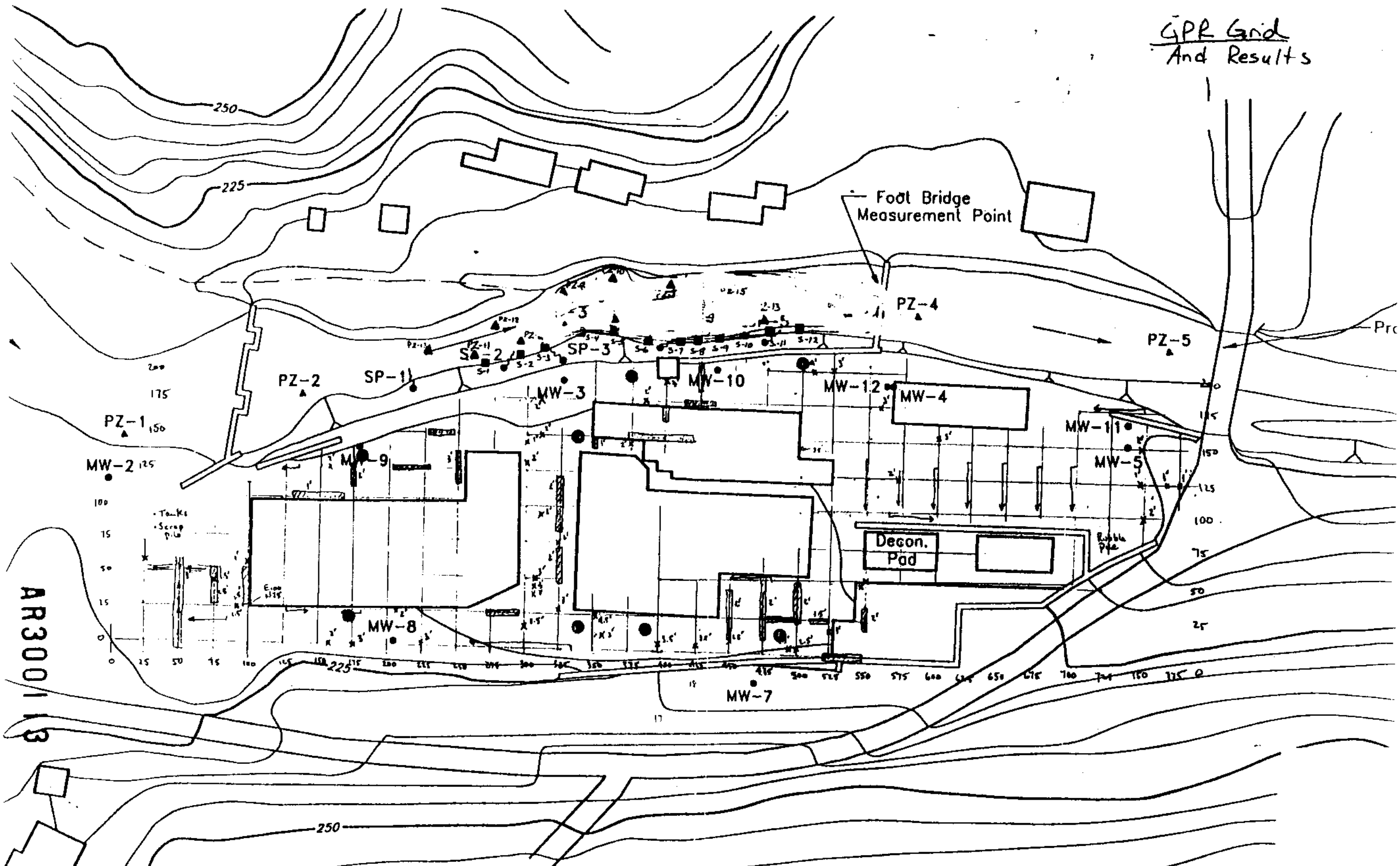


Figure 4
Conceptual Model of DNAPL Occurrence and Migration in the Overburden
Galaxy/Spectron FRI
Elkton, Maryland

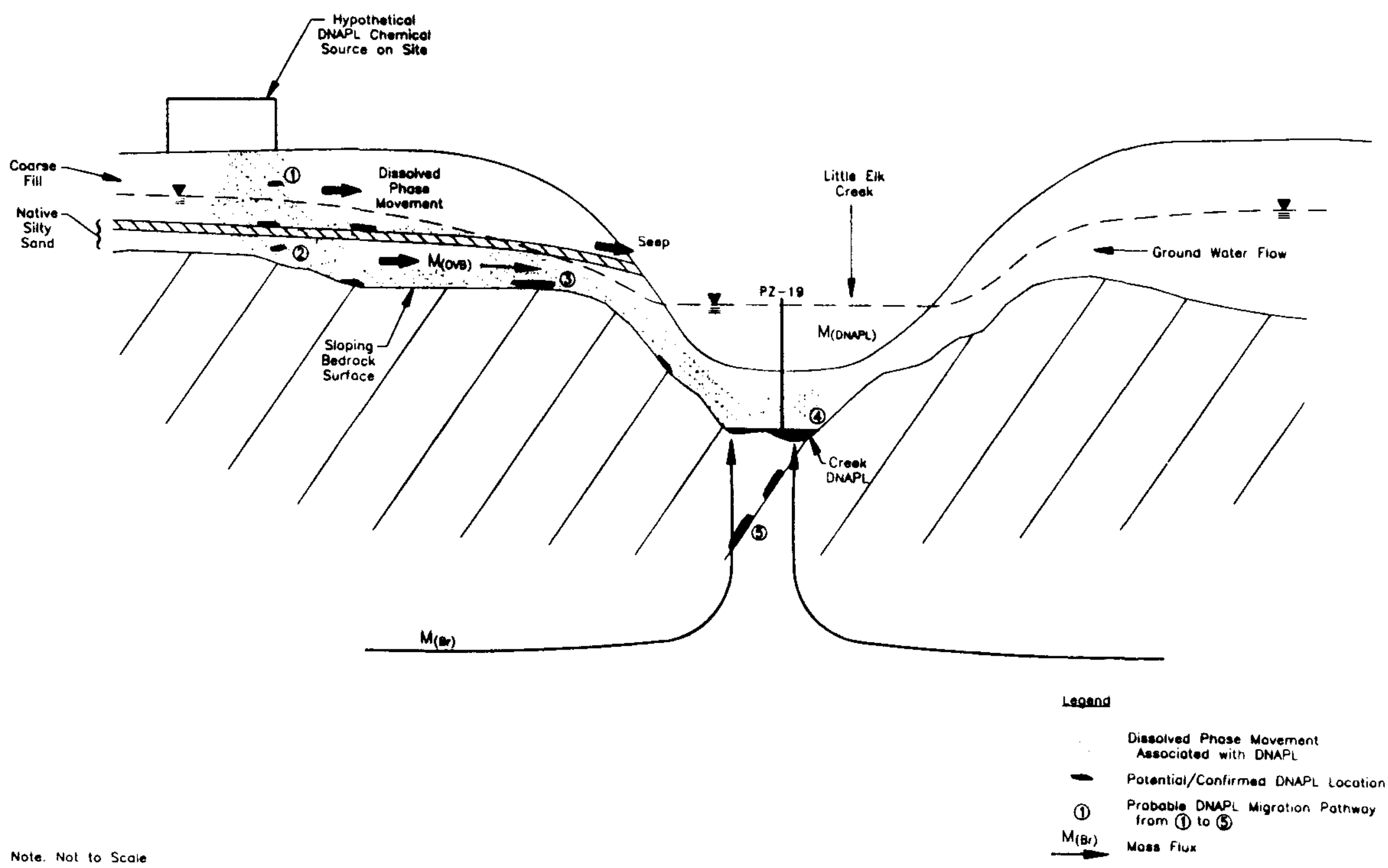
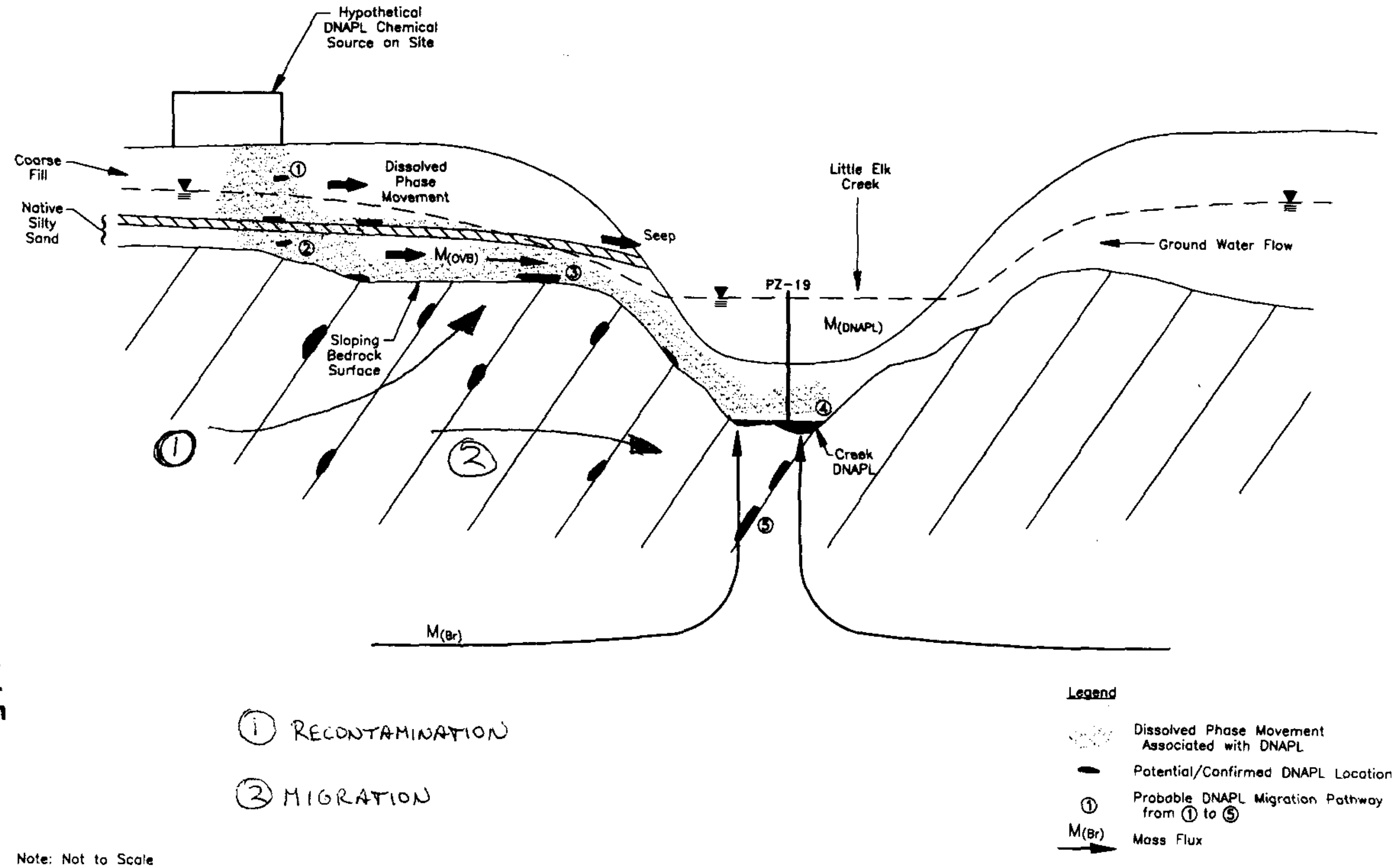


Figure 5
Conceptual Model of DNAPL Occurrence and Migration in the Overburden
Galaxy/Spectron FRI
Elkton, Maryland



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RANDY - WHAT ABOUT THIS AS AN ALTERNATE 7/3/96

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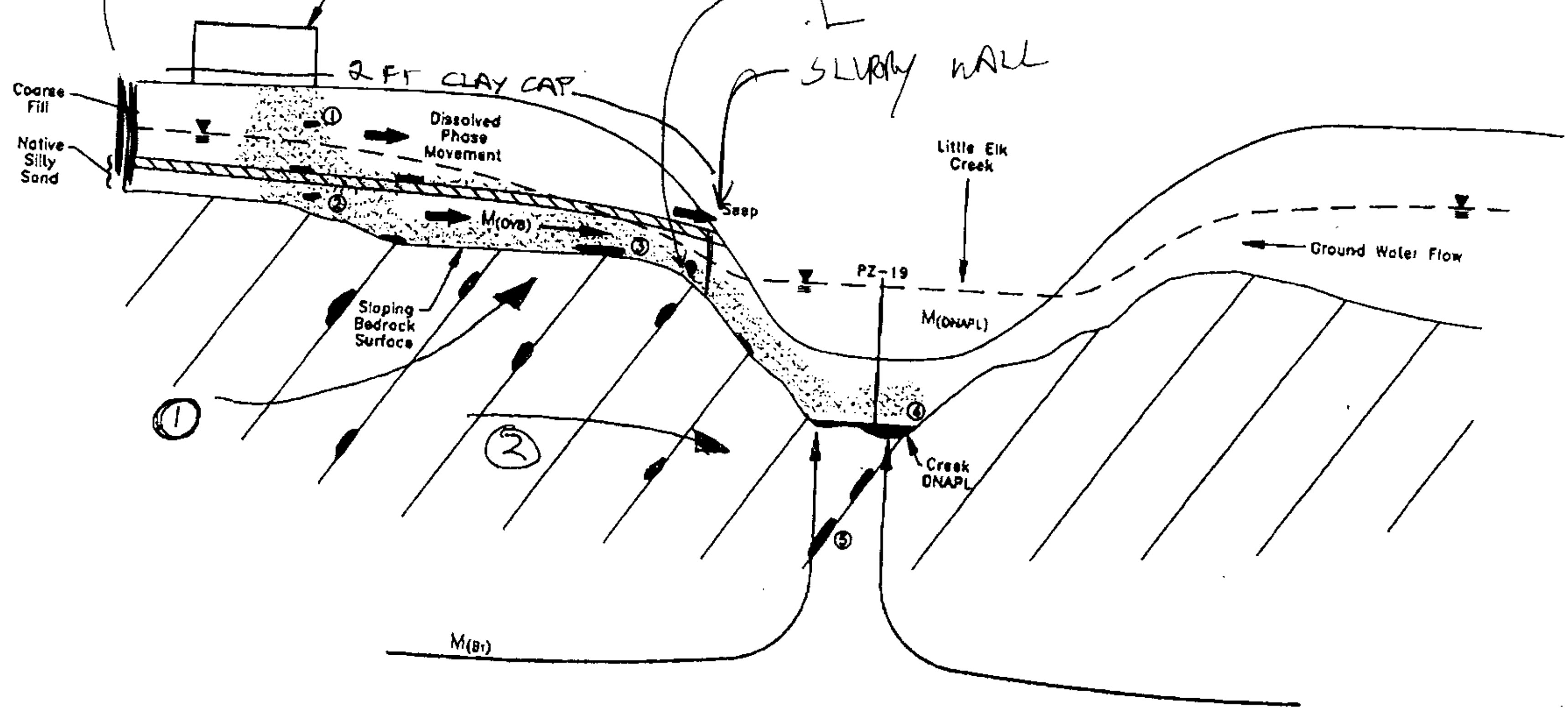
Figure 5
Conceptual Model of DNAPL Occurrence and Migration in the Overburden
Galaxy/Spectron FRI
Elkton, Maryland

SLURRY WALL - INSTALLED WITH WATER JET TO ENSURE CLOSE CONTACT WITH BEDROCK

GW EXTRACTION SYSTEM TO LOWER WATER TABLE AND CREATE LARGER ZONE FOR SVE



① RECONTAMINATION - DNAPL MIGRATING UP INTO NATIVE SOILS COULD BE CAPTURED BY COLLECTION SYSTEM OR DISSOLVED FRACTION REMOVED WITH GW COLLECTION SYSTEM.

② MIGRATION

Legend

- Dissolved Phase Movement Associated with DNAPL
- Potential/Confirmed DNAPL Location
- ① Probable DNAPL Migration Pathway from ① to ⑤
- M(Br) Mass Flux

Note: Not to Scale

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